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ABSTRACT

A study assessed the utility and effectiveness of two interactive computer programs designed to instruct and model effective strategies for reading biology and psychology textbooks. Intended for undergraduates, the two programs were developed at Indiana University's Learning Skills Center, and were designed to teach students how to: (1) identify key concepts; (2) compare, contrast, and connect ideas by writing linking summary statements; and (3) synthesize and graphically map relationships among key concepts. Subjects, 205 undergraduate students of matched ability from a major university and from a two-year community college, were assigned to treatment and control groups, and read two 7-10 page textbook selections with topics, text formats, and difficulty levels typical of most college level introductory texts in biology and psychology. The instructional format included explication of concepts, modeling of strategies, practice and feedback, and assessment and branching. Students who used the interactive computer programs significantly outperformed control group students; the fact that this pattern held in a test administered a week later which involved reading new texts without aid of the computer programs suggested successful transfer of the reading strategies. Interview and questionnaire data indicated that students viewed computer instruction positively. (Six tables of data are included, and 25 references are attached.) (SR)

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The Effectiveness of Using Interactive Computer Programs to Model Textbook Reading Strategies for University and Community College Psychology and Biology Students

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ABSTRACT

Interactive computer programs, developed at Indiana University's Learning Skills Center, were designed to model effective strategies for reading biology and psychology textbooks. For each subject area, computer programs and textbook passages were used to instruct and model for students how to 1) identify key concepts, 2) compare and contrast concepts, and 3) graphically map relationships among key concepts. Two hundred and five undergraduate students of matched ability from a major university and from a two-year community college were assigned to treatment and control groups to evaluate program effectiveness. Students who used the programs significantly outperformed ($p<.01$) control group students, and learned strategies which transferred to new and unmodeled textbook chapters.

Most beginning undergraduate students have the basic reading skills needed to understand a newspaper (Applebee, Langer & Mullis, 1985), but many of these students have difficulty reading and studying college textbooks. Cahalan and Farris (1986) report that 82% of all institutions of higher education and 94% of public institutions offer remedial courses to college undergraduates. The National Center for Educational Statistics reports that 25% of undergraduate students seek some form of remedial help with university-level study problems. In addition, this problem of undergraduates inadequately prepared to comprehend university-level material is even greater at smaller community colleges and open admission schools. Seventy-five per cent of students at two-year and open-admissions colleges are enrolled in remedial courses ("College remedial," 1985).

Techniques for improving undergraduate reading and study skills often involve instructors modeling for students cognitive and metacognitive strategies for identifying key ideas and relating ideas to form meaningful structures. The premise of the research reported in this paper is that an interactive computer program can model and guide undergraduate students through some of the important cognitive and metacognitive processes of reading college textbook chapters in such a way that: 1) comprehension of the modeled chapters is increased and 2) students are able to transfer the processes to new, unmodeled chapters effectively.

This manuscript reports results of a two-year research and development project funded by the Fund for the Improvement of Postsecondary Education (FIPSE) designed to develop and evaluate

the effectiveness of a series of print materials and interactive computer-guided study programs. These software packages lead undergraduate students to apply basic textbook reading strategies and concept mapping strategies to the study of natural and behavioral science textbooks. The materials and computer programs are designed to guide and help students:

* Identify key concepts in textbook chapters,
* Compare, contrast, and connect ideas by writing linking summary statements, and
* Synthesize and graphically map relationships among key concepts.

Reading Abilities and Demands of Entering Undergraduates

Over 56% of 17-18-year-olds go beyond high school to some form of post-secondary education. The percentage of students that enter colleges and universities is less clear due to differing definitions of what constitutes a college, but remains in the 40-50% range (Lisack & Shell, 1985).

Though complete data on the reading abilities of undergraduates does not exist, National Assessment of Educational Progress (N.A.E.P.) reading test results for 17-year-olds (Applebee, Langer & Mullis, 1985) allow us to draw inferences about the reading abilities of adolescents who enter colleges and universities. N.A.E.P. results for 1984 indicate that only 39.2% of 17-year-olds demonstrated adept comprehension strategies (able to find, understand, summarize, and explain relatively complicated information). Furthermore, only 4.9% attained an advanced level of strategy use (able to extend and restructure ideas in specialized texts). With current admissions in post-secondary

education close to 50% of 17-18 year-olds, one can expect a significant number of undergraduates to have difficulty comprehending relatively complicated textbook material and a majority to have difficulty restructuring and extending ideas from such specialized texts.

Several researchers have identified and characterized weaknesses that differentiate less competent readers from their more capable counterparts. Such readers are likely to have gaps in knowledge, have an impoverished understanding of relationships among facts, and are unlikely to make the inferences required to weave the text into a coherent whole (Bransford, Stein, Nye, Franks, Auble, Merynski, & Perfetto, 1982). Less able readers tend to use a listing rather than a structure strategy because they perceive all content as equally important (Meyer, 1984b; Meyer, Brandt & Bluth, 1980; Meyer & Rice, 1982).

Structure Awareness, Concept Mapping and Improved Reading

The results of several studies suggest that students who are aware of the structure of expository materials are able to outperform students who are not aware of text structure (McGee, 1982a; McGee, 1982b; Meyer, Brandt & Bluth, 1980; Taylor, 1980; and Taylor & Samuels, 1983). In addition, readers who are actively involved in constructing a structured representation of what they have read do better than their counterparts in recall performance (Armbruster & Anderson, 1980; Slater, 1982; Berkowitz, 1986; & Danner, 1976). Some researchers examining the effectiveness of having students graphically depict the

relationships among major concepts in text (concept mapping) have found carry-over benefits to related language activities. Ruddell and Boyle (1984) found that students who used concept mapping as a pre-writing exercise were able to write longer, higher quality essays than their counterparts. In addition, Geva (1983) found students who were taught to map or flowchart their understanding of expository material not only improved in mastery of the mapped material, but also improved in general reading ability as measured by a standardized reading test.

Role of Modeling and Computers

The modeling of cognitive processes has been suggested and examined by several researchers and educators as a method for clarifying to less able readers methods of thought while reading (Davey and Porter, 1982; Heller, 1986; Bereiter and Bird, 1985; Palincsar and Brown, 1984; Nist and Kirby, 1986; and Duffy, Roehler, et. al. 1987). Teacher modeling and direct instruction in the thought processes of reading comprehension has been identified as a promising approach for improving the reading performance of children and adolescents. Suggested techniques usually incorporate explication of the techniques being modeled, modeling of strategies and techniques to be used, and then student practice and feedback. An instructional format for effective computer-assisted instruction developed by Alessi and Trollop (1985) also includes:

1) explication of the concepts,
2) modeling of the strategy,
3) practice and feedback, and
4) assessment and branching.

Rationale of Study

Large percentages of undergraduate students seek aid in meeting the reading demands of college. It is likely that even larger percentages are in need of such aid. Interactive computer programs can help meet this need if they can effectively model and instruct students in cognitive and metacognitive reading strategies shown by existing research to be effective. This study assesses the utility and effectiveness of two interactive computer programs, each containing three lessons, and associated print materials in instructing and modeling for undergraduates how to comprehend and reconceptualize scientific textbook material. In addition to formative evaluation, the programs were evaluated by comparing the immediate and delayed post-program performance on textbook chapter tests of a treatment group of 106 biology and psychology students to the performance of a matched control group of 99 biology and psychology students. Post-program questionnaires and interviews were given to treatment group subjects and student interviews assessed student evaluation of computer program effectiveness.

METHOD

Subjects

The biology textbook computer programs and associated print used in this study were field tested with the aid of 25 undergraduate students enrolled in Learning Skills courses at Indiana University. Formative evaluations examined program clarity, usefulness, and student attitudes toward the programs. Responses from students were used to refine and debug early versions of the print materials and computer programs.

After the refinements had been made, volunteer students (matched on SAT verbal, high school rank, and current grade point average) from biology and psychology classes were assigned to treatment or control conditions using either biology or psychology programs. Due to differential attrition, the actual populations in each of the eight groups vary from 21 to 33 subjects. All students received biology or psychology class credit for participation in the experiment. Control group students used the programs after data had been collected.

Insert Table 1

Insert Table 2

Instruments and Materials

Textbook Passages: Both treatment and control biology students read two 7-10 page selections from the embryonic development and blood composition chapters of Elements of Biological Science (Keeton & McFadden, 1983). These selections and this text were selected with the aid of a Biology department faculty member, as topics, text formats, and difficulty levels typical of most college level introductory biology texts. In addition, treatment and control psychology students read two 7-10 page selections from the memory storage and behavioral therapies chapters of Psychology (Roediger, Rushton, Capaldi, & Paris, 1987). These chapters were selected with the aid of a Psychology department faculty member as being typical of most college level

introductory psychology texts. All four texts were assessed as being 14th grade difficulty using Gunnings' FOG formula (1952).

Computer Programs: Three 30-40 minute computer programs were designed to model effective reading strategies for biology text material. The programs modeled for students how to 1) identify key concepts within a text, 2) write linking summary statements which compare and contrast key concepts, and 3) graphically map relationships among key concepts.

It was originally thought that a successful shell program for teaching students strategies for reading and learning natural science text could be easily adapted to successfully instruct students how to use similar strategies for behavioral science textbooks. However, because psychology and biology are written in different styles, much more time and effort went into designing a similar program to the biology program, but using psychology text material, than had been originally planned.

The instructional format of the programs is adapted from Alessi and Trollop's (1985) suggestions for effective CAI. They include 1) explication of the concepts, 2) modeling of the strategy, 3) practice and feedback, and 4) assessment and branching.

- The Explication segments (generally at the beginning of each section) include a strong rationale and statement of purpose for the activity, as well as suggestions for transfer to the performance environment.

- Modeling is interspersed throughout the program and generally consists of a combination of examples and, when warranted, informative feedback.

- Students are required to Practice each step or group of steps to mastery before moving on through the program. Practice is set up in incremental steps to provide early success and reinforce each essential step in performing the strategy.

- Feedback is established as effective in CAI and the efficacy of feedback is proportional to its quality. Feedback in this program always includes knowledge of results and knowledge of correct response with feedback appropriate to the student's response--what mistake he or she is likely to make, where to look for information to self-correct, and how to avoid that error in the future.

- Answer judging always provides feedback, but sometimes includes interactive teaching if the student fails on a significant number of tries to produce a correct response. In these cases the program will Assess student performance and branch the user to remediation before returning the student to the question segment for another try.

Locus of control is offered to the students whenever possible. At least once in each lesson, the student can opt for an "Exercises Only" or an "Explanation plus Exercises" format. This choice allows the student to determine the level of detail in which the instruction is presented. If the student who chooses "Exercises Only" has performance problems, he or she is automatically branched to the "Explanation plus Exercises" section.

The screen design follows well-established parameters for document design with appropriate modification for the screen and for the target population. For example, each screen contains a prompt at the bottom of the screen that tells the student exactly what he or she needs to do to move through the program. Content-related direction lines are often contained in the text. In addition, the screens are numbered in the psychology program.

Because of students' tendencies to miss the relationships between ideas, screens are designed to interlock concepts so that related concepts are presented together on the same screen and the relationship is elaborated upon to make it more specific. Relationships are presented visually at every opportunity.

Students also are given a strong advance organizer at the beginning of each segment to tap into existing background knowledge and to set up a framework for the lesson. Each lesson section is introduced with a consistently-colored screen. When a user is in a section of his or her choosing, a small box in the upper left hand corner serves as a guide to the macrostructure.

Chapter Exams: Textbook chapter examinations were developed and piloted to test the ability of students to identify key ideas in textbook chapters, compare and contrast these ideas, and accurately depict relationships among key ideas. Parallel examinations were developed and field tested for biology and psychology chapters not modeled by the computer programs.

Clear-cut scoring guidelines were developed and piloted. Pilot work attained an inter-rater reliability correlation of r=.95 for the two raters scoring the tests on the biology material and an inter-rater reliability correlation of r=.98 for the two raters scoring the psychology material. Monitoring of inter-rater reliability using a 25% sample of later treatment and control subjects revealed correlations of r=.91 for the embryonic development test (biology), r=.96 for the blood composition chapter test (biology), r=.98 for the memory storage systems chapter test(psychology), and r=.99 for the behavioral therapies chapter test (psychology).

Procedures

The treatment groups were notified to schedule one one-hour appointment in the Learning Skills Laboratory. At that appointment each student completed the first lesson and scheduled

two more one-hour appointments to go through the next two computer lessons. Each student was observed by a research assistant who took notes about each student's interaction with the lessons, and after each lesson students were asked to answer a short questionnaire on the usability of the lesson. Upon completion of the third lesson, chapter examinations were given along with an open-ended questionnaire about the program and its usefulness in biology or psychology and in other courses. One week later students returned to read a new biology (blood composition text) or psychology text (behavioral therapies) and to complete a chapter examination.

The control groups were also asked to schedule a one-hour appointment during which they were provided with a text (embryonic development or memory storage systems text) and asked to read it without the help of the computer and to complete the same examination that had been taken by the treatment group. They also returned one week later to repeat the process with the new text (blood compostion or behavioral therapies text).

RESULTS

Chapter Examination Results

The chapter examinations were administered in order to determine the effectiveness of computer programs in modeling and teaching strategies for comprehending college-level textbooks. The treatment groups had instruction on the computer while using either the embryonic development or memory storage systems textbook chapter and were tested immediately after completion of the three program segments. The blood composition or behavioral

therapies chapter was read and tested upon one week later. The control groups, during two sittings, one week apart, read and were also tested upon the two texts.

The 4-year university biology treatment group scored significantly higher ($p<.05$ or better) than its matched control group on both the embryonic development and the blood composition chapter exams. The control group averaged approximately 62.9 (61.9 on embryonic development and 63.9 on blood composition) out of a possible 100 points on each chapter examination while the treatment group averaged approximately 79.7 (79.8 on embryonic development and 79.6 on blood composition) out of a possible 100 points on <u>each</u> examination. The 2-year community college biology treatment group scored significantly higher ($p<.05$ or better) on both chapters as well with the control group averaging approximately 58.9 (56.5 on embryonic development and 61.3 on blood composition) out of a possible 100 points on each chapter examination while the treatment group averaged approximately 72.8 (73.8 on embryonic development and 71.7 on blood composition) out of a possible 100 points on each chapter examination. Results are displayed in Table 3.

Insert Table 3

It was predicted that use of the computer programs would result in higher scores for the treatment groups on the first chapter test since that was the text used in the computer lessons. Of greater educational significance is the result that

the treatment group also significantly outperformed the control group a week later reading new texts without aid of the computer programs, suggesting transfer of the reading strategies beyond the single chapter covered in the computer programs.

Insert Table 4

Further analysis was undertaken on scores for subsections of the chapter examinations to determine which strategies were learned most effectively. When biology text data are aggregated across 2 and 4 year universities, treatment group students demonstrate scores significantly higher than control group student scores for all program lessons (significance levels range from $p<.05$ to $p<.001$). The key concept subsection of the blood composition chapter test dropped below the statistical significance level when the smaller 2-year and 4-year samples were analyzed. Even in these cases, however, the treatment groups consistently outscore the control groups by 8-9%.

Biology class test. An unplanned indicator of program success is the fact that treatment group students outperformed control group students on items related to embryonic development on their regularly scheduled biology class test which was not a part of this study. On questions related to embryonic development, the treatment averaged 94% correct while the control group averaged 72% correct.

Psychology text data, for the most part, parallels biology text data. On the modeled chapter (memory storage systems), the

treatment group significantly outscored the control groups for all lessons in 2-year, 4-year, and aggregate data. The treatment group students significantly ($p<.05$ to $p<.001$) outscored control group students on total score and key concept scores for the transfer chapter (behavioral therapies). (See Tables 5 & 6.)

Insert Table 5

Insert Table 6

Though treatment group students scored numerically higher than control group students for the linking key terms and mapping relationships portions of the chapter text, the score differences did not attain statistical significance. This could be due to the fact that the transfer psychology chapter might be slightly more structured than the initial psychology chapter allowing control group students to score more highly on the linking and mapping areas of the transfer task.

Interview and Questionnaire Results

At the end of each lesson, the treatment group was asked to complete a Likert scale to ascertain student opinions of the effectiveness of the computer in developing basic skills for comprehending natural and behavioral science text. The scale ranged from 5 (Strongly Agree) to 1 (Strongly Disagree). Questions addresed usefulness, user friendliness, and desirability of use. Mean results for the three computer lessons were consistently positive, ranging from 4.20 to 4.60. Students' positive

attitudes toward the programs demonstrated no significant differences in relation to sections of the programs. Items assessing program ease of use were consistently rated between 4.3 and 4.6 on a 5-point scale with no significant difference in ratings for lesson and program topic, and no significant difference on ratings of 2 and 4-year college students. Items assessing the degree to which students "liked" learning from the program lessons were rated between 3.4 and 4.5 on a 5-point scale. Though there were no statistically significant differences in ratings, in <u>every</u> comparison the biology program was "liked" slightly better than the psychology program and the 2-year college students liked the program slightly better than the 4-year university students.

Student comments during exit interviews included:

-You can apply this method to all subjects or chapters in them.

-I wish they had these for my brother in high school.

-Everything is clear about what you're supposed to do.

-I enjoyed the lessons. It's like X151 [an IUB Learning Skills course] without the extra work.

-I wish I'd learned to study a text before I got to college.

-I've learned to locate terms better. I've learned to differentiate terms. I've learned to see how terms are related.

At the end of lesson III students were asked to complete an open-ended questionnaire concerning the entire program. Among the questions asked of students was an item assessing the novelty of the study strategies for students. The question and responses follow below:

Have you ever before used the ideas presented in the computer program to:

		Yes	No
a.	locate key terms?	74%	26%
b.	compare and contrast key terms?	45%	55%
c.	map relationships among key terms?	18%	82%

For the vast majority of students in the treatment group, graphically mapping concepts was a new and unfamiliar task. In addition, comparing and contrasting key terms was also only reported as familiar by 55% of the students.

In answer to the question: "Has your ability to understand text material improved?", nearly 100% of the students answered "yes". Students were asked to expand upon the ways they thought their abilities had improved. Among the elaborations provided are:

- My biggest problem is fitting concepts together. Now I have a better feel about how to do it.
- Through organization of material. Now I have a structured method of study.
- Most of these ideas were already familiar to me, but using the lessons on the computer showed how advantageous these ideas are for learning text material.
- It takes a little more time to try and do the things you have learned (locating and comparing) but the benefits make it worth it.
- By learning to link key terms together and being better able to see the whole chapter made up of its smaller parts.

In an attempt to determine whether or not the students could see a transfer of the skills presented on the computer to other courses at the university, treatment group students were asked,

"In what ways, if any, will this lesson be useful for other courses in which you are enrolled?" A sample of comments follows:

- You can apply all the concepts of the experiment to other courses with maybe the exception of math.
- Yes for sociology, etc., but not for English classes, esp. literature.
- In almost all of my subjects, textbooks are used and set up in the same format. I hope to apply concepts learned to various areas.
- The ideas of locating key terms, comparing and contrasting, and mapping can all be used in other courses.
- Other courses where there is lots of reading involved such as my Human Development class which deals with many of the same concepts presented here.

CONCLUSIONS

With funding from F.I.P.S.E., the Learning Skills Center at Indiana University has developed a series of computer lessons to help students comprehend college level text material. Using guidelines for effective CAI and research on reading comprehension, the computer programs effectively model study strategies and concept mapping while providing for practice and feedback.

Significant treatment/control group differences in examination results support the hypothesis that "how to" strategies can be taught with the use of a computer. The treatment students outperformed the control students at a statistical $p<.01$ level or better on both chapter tests of the biology and psychology texts. Moreover, transfer occurred from the success with chapters modeled by the computer programs to new chapters for which there was no direct computer modeling.

Transfer was less consistently significant for some of the subsections of the psychology transfer chapter. This is likely due to the smaller variance present in the lower subsection scores. Concept mapping was reported to be a new concept by 82% of the treatment group. Interview and questionnaire data indicate that computer instruction is viewed positively by students as a way to learn strategies to read difficult material. Indications were that 1) the programs were user-friendly, 2) the strategies were new and useful, 3) the ability to understand text material had improved, and 4) study strategies transferred to use with new textbook chapters.

At a time when many students are enrolling in postsecondary institutions without the necessary skills to meet required study and reading demands, the computer can be a useful tool to teach effective strategies.

Table 1

Summary of Students Evaluating Software

	2-year	4-year
Biology	N=51 female=73% male=27%	N=50 female=66% male=34%
Psychology	N=60 female=55% male=45%	N=44 female=50% male=50%

Table 2

Population Description

	N	SATV	GPA	H.S. Rank
		Biology		
4-Year				
Treatment	25	422	2.7	top 27%
Control	25	426	2.6	top 28%
2-Year				
Treatment	26	325	2.6	top 50%
Control	25	331	2.3	top 45%
		Psychology		
4-year				
Treatment	21	470	2.6	top 23%
Control	23	464	2.5	top 23%
2-year				
Treatment	27	338	2.5	top 49%
Control	33	329	2.2	top 43%

Table 3

Mean Percentage Score Differences of Control and Treatment Subjects on Biology Chapter Exams

	Two-Year (N=51)		Four-Year (N=50)		Total (N=101)	
	C(25)	T(26)	C(25)	T(25)	C(50)	(51)
Embryonic Development						
1.	14.4	13.1	15.2	18.6***	14.8	17.4***
2.	16.4	18.8**	15.3	17.3*	15.8	18.0***
3.	27.7	38.8**	31.5	44.0***	29.6	41.4***
Tot.	56.5	73.8***	61.9	79.8***	59.2	76.8***
Blood Composition						
1.	15.8	17.6	16.8	18.4	16.3	18.0*
2.	17.3	18.7*	13.8	18.8***	15.6	18.7***
3.	28.2	35.4*	33.2	42.1***	30.7	38.7***
Tot.	61.3	71.7**	63.9	79.6***	62.6	75.6***

* $p<.05$ significance level
** $p<.01$ significance level
***$p<.001$ significance level

1. Subscore for Identifying Key Terms (20 possible)
2. Subscore for Linking Key Terms (20 possible)
3. Subscore for Mapping Relationships (60 possible)

Table 4

Mean Percentage Score Differences of Control and Treatment Subjects on Biology Chapter Exams

	Two-Year (N=51)		Four-Year (N=50)		Total (N=101)	
	C(25)	T(26)	C(25)	T(25)	C(50)	T(51)
Embryolonic Development						
1.	72%	81%	76%	93%***	74%	87%***
2.	83%	94%**	77%	86%*	80%	90%***
3.	46%	64%**	53%	73%***	49%	69%***
Tot.	57%	73%***	62%	80%***	59%	77%***
Blood Composition						
1.	79%	88%	84%	92%	82%	91%*
2.	89%	94%*	69%	94%***	79%	94%***
3.	47%	59%*	55%	70%***	51%	65%***
Tot.	61%	72%**	64%	80%***	63%	77%***

* $p<.05$ significance level
** $p<.01$ significance level
***$p<.001$ significance level

1. Subscore for Identifying Key Terms
2. Subscore for Linking Key Terms
3. Subscore for Mapping Relationships

Table 5

Mean Percentage Score Differences of Control and Treatment Subjects on Psychology Chapter Exams

	Two-Year (N=60)		Four-Year (N=44)		Total (N=104)	
	C(33)	T(27)	C(23)	T(21)	C(56)	T(48)
Memory Storage Systems						
1.	14.8	17.0*	15.7	19.3***	15.2	18.0***
2.	13.8	16.9***	17.2	19.0**	15.2	17.8***
3.	23.3	37.4***	34.7	43.5**	28.0	40.1***
Tot.	51.9	71.3***	67.6	81.8***	58.3	75.7***
Behavioral Therapies						
1.	14.7	17.4**	15.2	19.6***	14.9	18.3***
2.	11.3	12.4	13.7	15.5	12.3	13.7
3.	31.0	36.9	44.9	45.6	36.7	40.9
Tot.	57.2	66.7*	73.8	80.8*	64.0	72.6**

* $p<.05$ significance level
** $p<.01$ significance level
*** $p<.001$ significance level

1. Subscore for Identifying Key Terms (20 possible)
2. Subscore for Linking Key Terms (20 possible)
3. Subscore for Mapping Relationships (60 possible)

Table 6

Mean Percentage Score Differences of Control and Treatment Subjects on Psychology Chapter Exams

	Two-Year (N=60)		Four-Year (N=44)		Total (N=104)	
	C(33)	T(27)	C(23)	T(21)	C(56)	T(48)
Memory Storage Systems						
1.	74%	85%*	79%	97%***	76%	90%***
2.	69%	85%***	86%	95%**	76%	89%***
3.	39%	62%***	58%	73%**	47%	67%***
Tot.	52%	71%***	68%	82%***	58%	76%***
Behavioral Therapies						
1.	73%	87%**	76%	98%***	75%	92%***
2.	57%	62%	69%	78%	62%	69%
3.	52%	62%	75%	76%	61%	68%
Tot.	57%	67%*	74%	81%*	64%	73%**

* p<.05 significance level
** p<.01 significance level
***p<.001 significance level

1. Subscore for Identifying Key Terms
2. Subscore for Linking Key Terms
3. Subscore for Mapping Relationships

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